1/prts

ELECTRONIC CARD COMPRISING IN STORAGE ITS BEARER'S IDENTIFICATION

INS >
A1

The invention relates to an electronic card comprising in storage its bearer's identification.

Electronic cards with a memory and/or microprocessor, sometimes referred to as "smart cards", are often personalised, notably for banking applications or access control. The personalisation consists in general of a personal code in the memory of the card and/or data relating to the bearer entered on the card itself, such as a photograph of this bearer or his signature.

The data representing the bearer must, in general, involve a person responsible for the authentication. For example, he compares the signature produced on a separate sheet, such as a payment slip or annotation, with the signature on the card. This check offers a very limited guarantee, on the one hand because of the

risks of error in assessment by the checker and on the other hand because the signatures can be imitated by fraudsters.

Moreover, in order to compare the code in the memory of the card with the code stored by the bearer, it is necessary to have recourse to a reader with a keypad and, for the comparison between the code entered by the user by means of the keypad and the code in the memory of the card, this code must be presented at output terminals of the card. This presentation of the code at the output terminals constitutes a not insignificant risk of fraud. In addition, inserting the card in a reader constitutes an annoying constraint.

To avoid the presentation of the code at output terminals of the card, it is known that the latter can be provided with: a permanent memory containing dynamic characteristics of the signature of the bearer, a piezoelectric detection zone provided for an authentication signature, a processing means for analysing the signal supplied by the detection zone in order to derive therefrom dynamic characteristics of the signature to be authenticated and to compare them with the characteristics in memory, and means for supplying an authentication signal according to the result of the comparison between the dynamic characteristics in memory and the dynamic characteristics detected.

It is known that the dynamic characteristics of a signal are practically inimitable. This is because,

though the geometry of a signature can be imitated relatively easily, the dynamic characteristics of a signature, such as the pressure exerted at each point (or at certain points) on the writing support, the signature time, the speed and acceleration at each point or at given points and changes in direction made when the signature is made are parameters which are practically impossible for a third party to reproduce.

In addition, the technique of detecting the dynamic characteristics of the signature of the bearer requires the use of a memory of moderate capacity and the means used for reading dynamic signature information are simple.

However, such a card makes it necessary to provide the reader with means so that the card bearer can proceed with the signature when the card is inserted in the reader. In other words, the user has available only a fraction of the surface of the card, whose dimensions are intrinsically small, in order to appose his signature. In addition, manipulating the card when the latter is inserted in the reader poses problems which are difficult to resolve, notably with contact cards. This is because manipulating the card to effect signatures may make this card move and therefore alter the connection between the card contacts and a connector in the reader.

Summary of The Invention

The invention remedies these drawbacks.

The card according to the invention is characterised in that it has a means for allowing the power supply of the processing means or of the

comparison means outside a reader intended to read information on the card. Thus the signature can be effected at any point, for example on a support independent of the card reader.

The power supply makes it possible either to keep the dynamic characteristics of the signature in memory, or to keep the authentication of this card in memory.

In one embodiment, which allows immediate comparison between the dynamic characteristics of the signature effected for authentication and the dynamic characteristics of the signature permanently recorded, the card has a receiving antenna able to be supplied by induction, this antenna supplying with electrical energy a processing circuit and a microprocessor of the card for effecting the comparison.

In this embodiment, for the use of the card, recourse is had first of all to a support on which the card is to be placed, this support having a transmitting antenna for the supply by induction of the receiving antenna of the card. Next, if the card is of the contact type, it is inserted in a card reader, which allows validation, or not, according to the result of the authentication and, if the card has been authenticated, its use.

In a variant, the card has an energy source such as a battery or accumulator for recording the dynamic characteristics and comparing them, by means of a microprocessor, with the recorded characteristics.

In one embodiment, which allows the use of a low-capacity energy source, only the dynamic

characteristics of the signature are recorded but the comparison by means of the microprocessor of the card is effected when the latter is inserted in a reader which supplies to it the energy necessary for the functioning of the microprocessor.

In one embodiment, the electrical energy necessary for the storing of the dynamic characteristics of the signature and/or for the supply to the circuits allowing a comparison of these dynamic characteristics with those in permanent memory in the card, is obtained by means of piezoelectric or pyroelectric means. This embodiment is particularly favourable when the detection of the dynamic characteristics is effected by means of a piezoelectric membrane, for example a sheet of polyvinylidene fluoride. In this case it is, for example, the pressure exerted on this sheet which creates, in addition to the useful signals, the energy necessary for the power supply. It is also possible to use the pyroelectric effect which generally manifests in piezoelectric materials; for this purpose, it is for example possible to provide for the user to press his finger on the card so that the heat thus afforded creates the necessary electrical energy.

For certain applications such as cards which are to be used only once, the dynamic characteristics of the signature and/or the result of the authentication can be kept in memory for a long time.

However, with cards which are to be used several times, as is generally the case, preferably the dynamic characteristics of the signature or the authentication

are kept in the memory of the card for a limited time, for example around one minute. This arrangement is favourable to security in use of the card. This is because, if for example the card is stolen after the authentication signature, the risk of fraudulent use will be reduced. In addition, keeping in memory for a limited time allows the use of technologies which do not make it necessary to provide high electrical energy supplies in the card.

For entering the signature with a view to its putting in permanent memory and/or with a view to authentication, there is provided, for example, a sheet of piezoelectric polymer, such as a film of polyvinylidene fluoride, covered on each of its two faces with parallel conductive lines, the lines on the first face having a direction different from the direction of the lines on the other face. Under these circumstances, the surface of the piezoelectric sheet has as many detection points as there crossing points between the conductive lines on the two faces. The pressure exerted on the piezoelectric sheet generates a difference in potential which is detectable at each point on the sheet. The detection grating consisting of the piezoelectric sheet and the conductive lines also makes it possible to easily analyse the various dynamic parameters of the signatures, such as the speed of writing, the accelerations and the changes in direction.

In a variant, which is an easier embodiment, in order to avoid detections at a multiplicity of points,

two superimposed piezoelectric sheets are provided, one being covered on one face with parallel conductive lines and the other sheet also being covered with conductive lines parallel to each other but in different directions, notably perpendicular to the conductive lines applied to the first piezoelectric sheet. However, unlike the previous embodiment, in each sheet the even numbered conductive lines are all connected to the same terminal whilst the odd numbered lines are connected to another terminal. Thus the connection to the dynamic signature analysis circuit is effected only by means of four electrodes. The pressure exerted to produce the signature causes an alternating supply to the terminals which makes it possible to determine, in addition to the pressure exerted at each point, the axis and direction of the movements of the instrument used for effecting the signature.

In another variant, recourse is had to two sheets each having parallel conductive lines on each of the faces and in different directions on the two faces and, when a stylus presses at one point on a face, a conducting line on this face comes into contact with a conducting line on the other face, which causes a short-circuit indicating the passage of the stylus at this point. This variant is of economical design, since it is not necessary to provide a piezoelectric sheet and to measure the difference in potential at each point; however, it does not make it possible to measure the pressure of a stylus or pen. However, it

has been found that, without this parameter, the other dynamic characteristics of the signature make it possible to proceed with the authentication with a sufficient degree of reliability and security against fraud.

The signature for authentication will be effected with a stylus inscribing nothing permanently on the card or with a pen with erasable ink or a pencil.

The invention also relates to a circuit intended for an electronic card with a permanent memory, characterised in that it has a permanent memory for the storage of the dynamic characteristics of the signature of the bearer, processing means having inputs for signals representing a signature and supplying dynamic characteristics of a signal to be authenticated, means of comparing the dynamic characteristics of the signature to be authenticated with the characteristics recorded in permanent memory, and means for allowing the supply of electrical energy to the processing means and/or the comparison means outside a card reader.

This circuit is preferably such that it keeps in memory the signals supplied by the processing means or the signals supplied by the comparison means for a limited time.

Brief Description of the Drawings

Other characteristics and advantages of the invention will emerge with the description of some of its embodiments, this being given with reference to the accompanying drawings, in which:

Figure 1 is a circuit diagram for a card according to the invention,

Figure 2 is a diagram of a card according to the invention,

Figure 3 is a diagram of the signature detection part of a card for a variant of Figure 1,

Figure 4 is a view from above of Figure 3, and

Figure 5 is a view from below of Figure 3.

Description of the Invention

The example embodiments of the invention which will be described with the figures relate to a rectangular-shaped card having the standard format of a credit card. This card is intended for banking applications and/or for access control.

The card 10 has, on one of its faces, a sheet 10, one face of which is visible to allow an authentication signature. This sheet 10 comprises a piezoelectric polymer covered, on one of its faces, for example the visible face, with conductive lines (not shown in detail) and, on its other face, conductive columns (also not shown). The intersection of the lines and columns forms a grating of points. When a pen or stylus bears on the visible face of the sheet, this pressure creates, at each point, a difference in potential between the line and column concerned and this difference in potential represents the pressure applied. In addition, the grating of points makes it possible to know, at each moment, the position of the tip of the writing stylus.

For analysing the dynamic characteristics of the signature, a conventional processing circuit 14 is provided, having inputs 16_1, 16_2, etc, 16_n, connected to

the conductive lines and inputs 18_1, 18_2, ..., 18_p connected to the conductive columns.

The dynamic characteristics which are taken into account by the circuit 14 are, in addition to the pressure exerted at each point or at selected points, the speed of writing at each point, or at certain points the acceleration, the radial and tangential accelerations, the duration of the signature, and the changes in direction (the angles) of the signature.

These dynamic characteristics supplied by the processing circuit 14 are introduced into a temporary memory 20.

The data of the memory 20 are applied to inputs 22 of a microprocessor 24 having, in a permanent memory 26, the pre-recorded dynamic characteristics of the signature of the bearer. This microprocessor 24 is, in a conventional manner, able to be connected by contacts 28, such as those corresponding to ISO 7816, to a card reader with contacts. The contacts 28 are situated on the face of the card 12 which is opposite to the face on which the signature sheet 12 is situated.

The sheet 12 is, for example, disposed in the zone normally provided for the signature on credit cards (Figure 2). In other words, it is not necessary to provide a supplementary space in addition to those provided on credit cards.

In the embodiment depicted in Figures 3, 4 and 5, in order to avoid the large number (n + p) of connections of the sheet 12 to the circuit 14, only

four connections 40, 42, 44 and 46 are provided (Figures 4 and 5).

In order to obtain this result, the sheet 12 has two piezoelectric membranes 48 and 50. On the top face 48_1 of the sheet 48, a double grating 52 of parallel lines is provided, depicted in Figure 4. The lines in this grating are, in this example, along the width of the sheet 12. These lines are equidistant. They are grouped together in two subsets: the first subset comprises the lines 54_1, 54_3, etc, odd in number, and the second subset comprises the lines 54_2, 54_4, etc, even in number. The lines in the first subset are all connected to the terminal 40 whilst the lines in the second subset are all connected to the terminal 42.

The second piezoelectric sheet 50 has, on its bottom face 50_1, the grating 56 depicted in Figure 5, which is similar to the grating 52 depicted in Figure 4 but in a direction at right angles. In other words, the lines 58 in the grating 56 are parallel to each other and along the length of the sheet 12. The lines 58_1, 58_3, etc of odd rank are connected to the terminal 44 whilst the lines 58_2, 58_4, etc of even rank are connected to the terminal 46.

The bottom face of the membrane 48 is covered by an earthed electrode 60 (Figure 3). Likewise, the top face of the piezoelectric membrane 50 is covered with a metallic electrode connected to earth.

In order to be able to correctly distinguish the direction of movement of the writing stylus, in each grating, 52, 56, provision is made for the distance

from an electrode with a rank of a given parity to the following electrode of the other parity to be substantially different from the distance separating this last electrode from the following electrode in the first parity. For example, an odd electrode is followed by an even electrode at a distance D1, whilst the distance D2 separating this even electrode from the following electrode of odd rank is at a distance D2 greater than D1. For example, the distance separating the electrodes 54_5 and 54_4 is substantially greater than the distance separating the electrodes 54_4 and 54_3, and so on. In this way, when the stylus moves from left to right, the shortest distance between two time pulses corresponds to a first signal at the terminal 40 and a second signal at the terminal 42. In the contrary case, that is to say for a movement from right to left, the shortest distance in time corresponds to a signal which appears first of all at the electrode 42 and then at the electrode 40.

The combination of data supplied by the two piezoelectric membranes supplies information on the axis and direction of movement of the stylus effecting the signature, the two piezoelectric sheets also supply information on the pressure. The axis and direction are obtained by determining the times of appearance of the signals at the terminals 40 and 42 and at the terminals 44 and 46. The direction is a function of the order of appearance of the signals at the terminals 40 and 42 and at the terminals 44 and 46. These

signals also supply information on the speed and acceleration.

With respect to the embodiment depicted in Figure 1, the example shown in Figures 3, 4 and 5 does not provide any information about the position of the signature on the sheet 12. However, this information is of little significance for identifying the dynamic characteristics of the signature.

According to an important provision of the invention, supply means are provided allowing the temporary functioning of the processing circuit 14 and possibly of the microprocessor 24 in order to permit the recording of the dynamic characteristics of the signature and/or the supply of an authorisation signal, independently of a reader in which the card 10 is subsequently to be introduced. In this way, the bearer of the card can sign, without constraint, on any support or on an adapted support.

To this end, in one embodiment (not shown), the card has a receiving antenna intended to be supplied with electrical energy by induction by means of a sending antenna, and the antenna of the card supplies the circuits 14 and 24 with electrical energy. In this embodiment, the reading means (not shown) have two parts, namely on the one hand a support with the sending antenna, on which the user can effect his signature for authentication, and on the other hand the reader proper for reading the contact card 28.

In this case, the comparison is effected after the effecting of the signature, and the memory 20

automatically empties at the end of the comparison. On the other hand, the authentication signal is kept in an appropriate memory of the microprocessor 24.

This keeping of the authentication signal in the memory of the microprocessor 24, or in another memory, is preferably effected over a limited length of time, for example 30 seconds or one minute, so that the card cannot be used fraudulently when it is a card which is to be used several times.

This last characteristic, according to which the authentication signal must be kept for a limited length of time in memory, applies whatever the supply mode used for the circuits 14 and/or 24. It also applies in the case where other supply means are provided as described below.

It should also be noted that, whatever the type of supply, the dynamic characteristics of the signature are kept in the temporary memory 20 only for a sufficient length of time for the comparison with the characteristics recorded in the memory 26. After this comparison, the microprocessor 24 supplies an authorisation or invalidation signal.

The memory 20 is a random access memory. The temporary keeping of the information consists, in one example, of providing a timing means, for example controlled by an internal clock or by the discharge of a capacitor, and proceeding with an erasure of the content of the memory 20 after the elapse of the prescribed time.

Likewise, when the authorisation signal is kept temporarily, a means is also provided for erasing this authorisation signal after the lapse of a time determined by a timing means such as a clock or the discharge of a capacitor.

According to yet another embodiment, the card 10 has its own supply source so as to allow the storage in memory of the dynamic characteristics of the signature and/or of the authentication, outside a reading appliance. This internal source consists, for example, of a battery or accumulator. To minimise the power of the energy source, it is preferable for this to be provided only for the functioning of the processing circuit 14 but not for the functioning of the microprocessor 24. In this case, the dynamic characteristics of the signature are kept in the temporary memory 20, preferably for a limited length of time as indicated above. The authentication is effected next when the card is introduced into an appropriate reader which allows the supply of the microprocessor 24.

For the supply, recourse can also be had to a piezoelectric sheet, for example the piezoelectric sheet or sheets provided for the zone 12.

The energy can also be provided by pyroelectric effect. In this case, it is preferable to use, for detecting the dynamic characteristics of the signature, a piezoelectric sheet which also has pyroelectric characteristics.

For the use of the pyroelectric effect, in one example a zone of the card is reserved on which a finger is pressed and the heat afforded by the pressure of the finger produces the electrical energy necessary for the functioning of the circuit 14 and/or of the microprocessor 24.

It should be noted that the invention is compatible with a card which can be validated by its identification number, the combination of a validation by the signature and by the identification number constituting great security against fraudulent use of the card.

It will also be noted that the invention encompasses the combined use of the dynamic and static, that is to say geometric, characteristics of the signature for authenticating the card.

Whatever the embodiment, the signal resulting from the comparison of the dynamic characteristics of the signature to be authenticated with the characteristics recorded in permanent memory may or may not make it possible to pursue a transaction with an apparatus such as a card reader. For example, a reader may, in the context of a dialogue with the card, find, during an authorisation period, the validation information in a temporary memory of the card and pursue the transaction after the elapse of this authorisation period.

According to one embodiment, the validation signal is capable of causing the total or partial inhibition of one of the functions, or means, of the card, for example the inhibition of a response to a mutual

recognition signal or the inhibition of an application, in the case of a multiapplication card.

For this purpose the card has, in this embodiment, means of total or partial inhibition of functions or means of this card. The inhibition, or blocking, may be triggered after several fruitless validations. Unblocking means may be provided as an option.

The signal resulting from the said comparison makes possible, in one embodiment, the opening of a dialogue with a reader and the pursuit of its functioning, for example by virtue of a logic gate situated in the card circuits, this card opening or closing an electrical contact in connection with the contact areas on the card, or with a communication interface.

The keeping of the logic gate in the open position may be relayed by the reader, once the dialogue has been established, in spite of the expiry of the authorisation period.